REMARKS/ARGUMENTS

Claims 10, 12-16, and 18 are pending in this application. By this Amendment, Applicant amends Claim 10 and cancels Claims 11 and 17.

Claims 10-18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Lipskier (U.S. 5,910,286) in view of Kadota (U.S. 6,366,002) and Springer et al. ("Wireless Identification and Sensing Using Surface Acoustic Wave Devices"). Claims 11 and 17 have been canceled. Applicant respectfully traverses the rejection of Claims 10, 12-16, and 18.

Claim 10 has been amended to recite:

> A surface acoustic wave sensor for detecting the minute mass applied to a surface acoustic wave element on the basis of the change in frequency using an SH-type surface acoustic wave, the surface acoustic wave sensor comprising:
>
> **a rotated Y-cut $LiTaO_3$ substrate having Euler angles of (0°, 120° to 140°, 0° ± 5°)**;
>
> electrodes, principally containing Au, and arranged on the $LiTaO_3$ substrate to excite a surface acoustic wave; and
>
> a reaction membrane, bound to a target substance or a binding substance bound to the target substance, covering the electrodes arranged on the $LiTaO_3$ substrate; wherein
>
> **the electrodes have a normalized thickness of 3.0% to about 5.0%, the normalized thickness being determined by normalizing the thickness of the electrodes by the wavelength of the surface acoustic wave**;
>
> the surface acoustic wave element is a resonator type surface acoustic wave element; and
>
> the electrodes include at least one interdigital electrode and reflectors arranged on both sides of the at least one interdigital transducer in a direction of propagation of a surface acoustic wave. (emphasis added)

With the combination and arrangement of features recited in Applicant's Claim 10, including the features of "the rotated Y-cut $LiTaO_3$ substrate has Euler angles of (0°, 120° to 140°, 0° ± 5°)" and "the electrodes have a normalized thickness of about 3.0% to about 5.0%, the normalized thickness being determined by normalizing the thickness of the electrodes by the wavelength of the surface acoustic wave," Applicant has been

able to provide a surface acoustic wave sensor which includes a surface acoustic wave element with an improved structure and which therefore has high sensitivity. In particular, the surface acoustic wave sensor including the features recited in Applicant's Claim 10 functions well even if the temperature changes by about 1.3˚C and about 1.6˚C. That is, if a temperature change causes a change in frequency, the surface acoustic wave sensor recited in Applicant's Claim 10 still functions well and still accurately detects a minute mass applied to the surface acoustic wave element (see, for example, paragraphs [0009], [0060], and [0061] of Applicant's originally filed Substitute Specification and Figs. 5 and 6 of Applicant's originally filed drawings).

Applicant's Claim 10 has been amended to recite the features of "the rotated Y-cut $LiTaO_3$ substrate has Euler angles of (0°, 120° to 140°, 0° ± 5°)" and "the electrodes have a normalized thickness of about 3.0% to about 5.0%, the normalized thickness being determined by normalizing the thickness of the electrodes by the wavelength of the surface acoustic wave," which were previously recited in Applicant's Claims 11 and 17.

The Examiner alleged that Lipskier teaches all of the features recited in Applicant's Claims 10, 11, and 17, except for the surface acoustic wave transducer being a rotated Y-cut $LiTaO_3$ substrate having Euler angles of (0°, 120° to 140°, 0° ± 5°); the electrodes being made of gold and having a normalized thickness of about 3.0% to about 5.0%, the normalized thickness being determined by normalizing the thickness of the electrodes by the wavelength of the surface acoustic wave; and the electrodes including reflectors arranged on both sides of the interdigital transducer in a direction of propagation of a surface acoustic wave.

The Examiner further alleged that Kadota teaches a rotated Y-cut $LiTaO_3$ substrate having the recited Euler angles, and the electrodes being made of gold and having a normalized thickness of about 3.0% to about 5.0%; and that Springer et al. teaches a SAW device which includes reflectors.

Thus, the Examiner concluded that it would have been obvious (1) to substitute a $LiTaO_3$ surface acoustic wave device with gold electrodes in the chemical sensor of

Lipskier, as taught by Kadota, "since doing so causes the propagation loss to become substantially zeros even where the film thickness is extremely small;" and (2) "to incorporate reflector gratings into the SAW device of modified Lipskier, as taught by Springer, since doing so would direct acoustic wave energy through the piezoelectric material to compensate for the instability effects produced by the preferential direction of transmission exhibited by the piezoelectric material." Applicant respectfully disagrees.

At best, Kadota teaches IDT electrodes 3 that have a broad range of normalized film thickness of about 5% or less. Kadota fails to teach or suggest any specific lower limit for the normalized film thickness of the electrodes, and certainly fails to teach or suggest that the lower limit for the normalized film thickness could or should be about 3% as recited in Applicant's Claim 10.

The Examiner is reminded that Applicant can rebut a *prima facie* case of obviousness based on overlapping ranges by showing the criticality of the claimed range. "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical…" *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990).

Fig. 5 of Applicant's originally filed drawings shows the change in frequency caused by applying a mass of 10 ng/mm^2 to surface acoustic wave elements including interdigital transducers (electrodes) having different normalized thicknesses. As clearly shown in Fig. 5 of Applicant's originally filed drawings and disclosed in paragraphs [0057] to [0061] of Applicant's originally filed Substitute Specification, the amount of frequency change caused by a mass of about 10 ng/mm^2 being applied to a surface acoustic wave element including electrodes having normalized thicknesses of less than 3.0% is drastically decreased as compared to a surface acoustic wave element including electrodes having normalized thicknesses of about 3.0% to 5.0%.

Due to this drastically decreased frequency change, a surface acoustic wave sensor that includes electrodes having normalized thicknesses of less than 3.0% is

capable of accurately detecting the mass applied to the surface acoustic wave element over only a very small range of temperatures, and thus, is unsuitable for most practical application. In contrast, the surface acoustic wave sensor recited in Applicant's Claim 10, including the feature of "the electrodes have a normalized thickness of about 3.0% to about 5.0%, the normalized thickness being determined by normalizing the thickness of the electrodes by the wavelength of the surface acoustic wave," functions significantly better over a much greater temperature range, and is thus, suitable for most practical applications.

Kadota is directed to a surface acoustic wave **filter**, and merely teaches that the propagation loss of the surface acoustic wave filter can be reduced when the normalized film thickness of the electrodes is about 5% or less. Kadota fails to teach or suggest that the surface acoustic wave **filter** disclosed therein could or should be used as a surface acoustic wave element in a surface acoustic wave **sensor** for detecting a minute mass applied to the surface acoustic wave element, and the Examiner has failed to provide any evidence whatsoever that the surface acoustic wave filter of Kadota is even suitable for use as a surface acoustic wave element in a surface acoustic wave sensor for detecting a minute mass applied thereto.

Since Kadota fails to teach or suggest anything at all about a surface acoustic wave sensor for detecting a minute mass applied to the surface acoustic wave element, Kadota clearly does not and would have no reason to teach or suggest any relationship whatsoever between the change in frequency caused by applying a mass of 10 ng/mm^2 to surface acoustic wave elements including electrodes and the different normalized thicknesses of the electrodes or that there would have been any criticality to a lower limit of 3.0% for the normalized thickness of the electrodes.

Therefore, Applicant respectfully submits that the Examiner has clearly failed to establish a *prima facie* case of obviousness in the rejection of Claim 10.

In addition, Lipskier discloses that the intermediate layer L1 shown in Fig. 4A, which is in direct contact with the electrodes SE_1 and SE_2, is made of gold. If, as alleged by the Examiner, the $LiTaO_3$ substrate and gold electrodes of Kadota were

substituted for the piezoelectric substrate and electrodes SE_1 and SE_2 of Lipskier, then the intermediate layer L1 of Lipskier and the electrodes would both be made of Au and would be in contact with each other, which would render the chemical sensor of Lipskier inoperative and completely incapable of exciting a surface acoustic wave therein.

The Examiner is reminded that if the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984) and MPEP § 2143.01.

The Examiner relied upon Springer et al. merely to teach reflectors and certainly fails to teach or suggest the features of "the rotated Y-cut $LiTaO_3$ substrate has Euler angles of (0°, 120° to 140°, 0° ± 5°)" and "the electrodes have a normalized thickness of about 3.0% to about 5.0%, the normalized thickness being determined by normalizing the thickness of the electrodes by the wavelength of the surface acoustic wave" as recited in Applicant's Claim 10. Thus, Springer et al. fails to cure the deficiencies of Lipskier and Kadota described above.

Therefore, Applicant respectfully submits that Lipskier, Kadota, and Springer et al., applied alone or in combination fail to teach or suggest the features recited in Applicant's Claim 10.

Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection of Claim 10 under 35 U.S.C. § 103(a) as being unpatentable over Lipskier in view of Kadota and Springer et al.

In view of the foregoing amendments and remarks, Applicant respectfully submits that Claim 10 is allowable. Claims 12-16, and 18 depend upon Claim 10, and are therefore allowable for at least the reasons that Claim 10 is allowable.

In view of the foregoing amendments and remarks, Applicant respectfully submits that this application is in condition for allowance. Favorable consideration and prompt allowance are solicited.

The Commissioner is authorized to charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 50-1353.

Respectfully submitted,

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